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ART. XV.—*A Note on the Symbiosis of Loranthus and Eucalyptus.*

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(With Plate XXVIII.)

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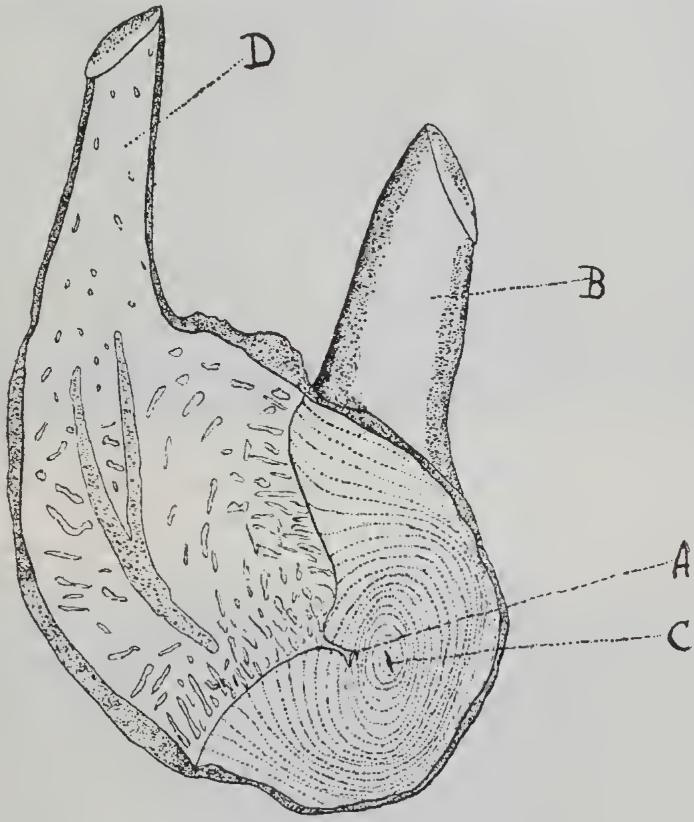
Although a large body of literature is available in regard to the degree of parasitism between the non-Australian species of Viscum and Loranthus, comparatively little precise information is to be found in regard to the degree of parasitism of the Australian species of Loranthus. The generally accepted view is that they merely receive water and salts from their host and manufacture all their own organic food materials by photosynthesis. According to Wood (1) *Loranthus quandang* growing on such an Acacia as the mulga (*Acacia aneura*) had a transpiration rate occasionally over eight times as great for short periods, but on the average over long periods its transpiration is between five and six times as active as that of its host, and hence during dry periods the leaves of an infected plant are bound to suffer from want of water, owing to the wasteful and extravagant transpiration rate of the parasitic mistletoe. This alone would be sufficient to explain the injurious effect of mistletoe upon a badly infected tree. In the case of a Eucalyptus, the disparity between the rate of transpiration of the host and of the parasite is not so great, and the possibility of a passage of elaborated food materials from the parasite to the hosts needs consideration. Various European observers have gone so far as to state that a definite symbiosis exists between the evergreen European Viscum and certain of the deciduous trees on which it grows; in winter time the Viscum supplying food materials to its leafless host.

Brittlebank (2) states that in the case of *Loranthus exocarpi* at the point of contact one (or occasionally more than one) sinker is commonly developed, which bores through the stem and appears on the opposite side, where it broadens to form a dove-tail connection. He also figures remarkable cases of star-like formations of *Loranthus* tissues resembling broad medullary rays in the tissues of the host plant.

None of these remarkable appearances has been seen in *L. pendulus*. Here the parasite does not penetrate further after it has reached the wood, and the subsequent growth is lateral, while at the junction line, the tissues interlace without either penetrating deeply in the other. Occasionally at the border line, owing to the crumpling of the tissues, an external appearance resembling the formation of ingrowths may develop, but this is merely because the two cambiums are somewhat folded. There is no boring of the parasite into the wood of the host after the wood has once developed.



TEXT-FIGURE I.

Section of point of union between the tissues of *L. pendulus* and *Eucalyptus hemiphloia* var. *microcarpa* before the death of the distal end of the shoot. A, disc by which the Loranthus attached itself to the tissues of the host; B, stem of host; C, original centre of growth of the stem of the host; D, stem of parasite.

Text-Fig. 1 shows a section of the point of union between the tissues of *L. pendulus* and *Eucalyptus hemiphloia* var. *microcarpa* before the death of the distal end of the shoot had taken place. At C, the original centre of growth of the stem is shown, and at A, the disc by which the Loranthus attached itself to the tissues of the host. All the growth has taken place on the outside of the stem of the host, and has resulted in a distortion of the annual rings. The growth of the parasite begins laterally, but, owing to the removal of large quantities of water from the branch by the parasite, the terminal portion of the branch is gradually killed, and the parasite ultimately assumes a terminal position provided the branch was infected while young.

Brittlebank (2) draws attention to the fact that at the point of junction starch is much more abundant in the Loranthus tissue than in the tissue of the host plant. He concludes from this fact that the Loranthus is drawing starch from its host. In all such cases, however, there is more or less of a block in the translocation channel at the point of junction between the host and the parasite, so that if starch were passing from the host to the parasite an accumulation of starch should be shown, it is true, at the point of junction, but it would be in the tissues of the host and not in that of the parasite. The real explanation appears to be, firstly, that the tissues of the Loranthus are less woody, and contain more starch-bearing parenchyma, and, secondly, that the Loranthus uses its enlarged base as a storage place for starch manufactured in its own leaves.

Some observations recently made in the field seem to show that Loranthus can supply food materials to a leafless host, and to indicate that for a time at least a Eucalyptus stock which has no foliage of its own can be nourished by a parasitic Loranthus, i.e. that a relationship may be established analogous to that between the stock and scion in a grafted plant.

A few preliminary observations did not indicate so pronounced a difference between the rates of transpiration of the hanging mistletoe (*L. pendulus*) and of plants of *Eucalyptus hemiphloia*, on which it was parasitic, as that observed by Wood in the case of the mulga and *L. exocarpi*. In the case of *L. pendulus* and *E. polyanthemos*, the former appeared to have an average transpiration rate for equal leaf areas, about four times as great as that of the host when both were under optimal conditions for transpiration. Isolated leaves of mistletoe have little control over their transpiration rate, and droop rapidly, whereas in the case of isolated leaves of Eucalyptus the transpiration rate soon falls, so that the leaf cells remain turgid for long periods of time.

The following observations indicate strongly the possibility of a food transference. Trees can often be seen living which bear much more mistletoe foliage than they do of their own. In Long Forest a natural graft of *Loranthus pendulus* on *Eucalyptus hemiphloia* var. *microcarpa* (Fig. A of Plate) is growing, and is nearly five feet high. It has now been under observation for three years. On November 1st, 1923, though the stock bore no eucalypt leaves, the mistletoe was fruiting freely. Up to December, 1924, the plant was still vigorous, and again fruiting. Both stock and scion were growing in diameter, so that the stock must have received food materials from the scion. It is proposed later to examine the amount of wood formed on each part of this natural graft. Another graft was found in the Ironbark Forest on March 15th, 1924 (Fig. B of Plate). It was 7 feet high, with a long leg of *Eucalyptus sideroxylon* bearing seven leaves only, and a terminal cluster of *Loranthus pendulus*. The eucalypt

Fig. B.

Fig. A.